MACHINE AUGURIES

Alexandra
Daisy
Ginsberg

ALEXANDRA DAISY GINSBERG
MACHINE AUGURIES: TOLEDO

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Alexandra Daisy Ginsberg
Machine Auguries: Toledo

The dawn chorus of collective bird song—where birds call for mates or mark their territory—is the ecological soundtrack that rings in the arrival of a new spring and summer day. However, humans' compulsive need for 24/7 access to information and connection has increased urban and suburban levels of sound and light. This negatively impacts the species that we share these environments with, overpowering their modes of communication to their detriment—if not their eventual end—as it interferes with their reproductive strategies and their attempts to establish territories.

Artist Alexandra Daisy Ginsberg has dedicated her practice to exploring the intersection of technology and the natural world. With the dawn chorus as a critical starting point, *Machine Auguries: Toledo* utilizes artificial intelligence to examine the effects of humans' relentless demands on the environment. And like an augury, or omen, the work suggests a possible future. The experience of *Machine Auguries* becomes a melancholic space of mourning, but also a meditation on how humans and the natural world are intricately intertwined and interdependent.

—Jessica Hong, Curator of Modern and Contemporary Art
Toledo Museum of Art

Portrait of Alexandra Daisy Ginsberg © Nathalie Théry

About the Artist

Alexandra Daisy Ginsberg is a multidisciplinary artist examining our fraught relationships with nature and technology. Through artworks, writing, and curatorial projects, Ginsberg's work explores subjects as diverse as artificial intelligence, synthetic biology, conservation, biodiversity, and empathy, as she investigates the human impulse to "better" the world.

Ginsberg completed her PhD by practice at London's Royal College of Art in 2017. She exhibits internationally, including at MoMA New York, the Museum of Contemporary Art, Tokyo, the National Museum of China, the Centre Pompidou, and the Royal Academy. Her work is held in private and museum permanent collections, including the Art Institute of Chicago, the Cooper Hewitt, Smithsonian Design Museum, Therme Art, and ZKM Karlsruhe.

A resident at Somerset House Studios, London, in 2022 Ginsberg launched her latest commission *Pollinator Pathmaker*, a living artwork devised using an algorithmic online tool. Current Edition Gardens include a 55m permanent installation at the Eden Project, Cornwall, and eleven meandering beds in Kensington Gardens, London, commissioned by the Serpentine. The first International Edition Garden will be planted in summer 2023 for Light Art Space, Berlin.

A WORLD IN A GRAIN OF SAND

Interview *

JESSICA HONG
Curator of Modern and Contemporary Art,
Toledo Museum of Art

ALEXANDRA DAISY GINSBERG
Artist
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Jessica Hong Your work brings together the seemingly disparate realms of technology and the natural world. Can you explain the ways in which they are actually intertwined, not only in your practice but across the environments in which we live and function?

Alexandra Daisy Ginsberg We are taught that nature and culture are separate or even opposites. But this separation between the things that already exist and the things we make, including our technologies, is the artificial thing here. What we think of as the world is not reality, it's just the way we've each learned to see and experience it: framed through the ideas of Western modernity, a mode of thinking that's emerged over the last 500 years. Many Indigenous cultures, for example, have very different ways of being in the world.

“Nature” is a concept that we created to label the wild, dangerous stuff that we emancipated ourselves from to become “human” rather than animals. Today, the natural is not some untainted other. We have been breeding plants and animals for 10,000 years while extracting from and modifying landscapes, all for our benefit. Even what we think of as wildernesses are not wild. These are areas that are surveilled, maintained, and crucially, artificially enclosed.

Perhaps a more helpful way to think about this is that everything is nature, or that without nature there is nothing. Everything flows from our environment and its well-being. Without nature, we cannot exist.

My practice looks at the strange prioritization we give to the new—the things we create—over the things that already exist. I explore technologies that sit on the edge of the creation and recreation of life itself, from synthetic biology to artificial intelligence, which muddy the neat edges of the

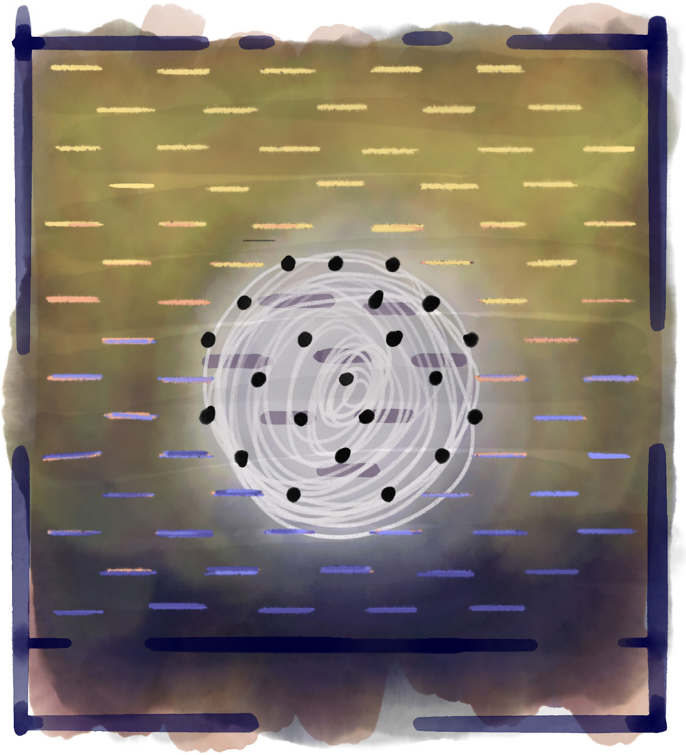
[FIG. 1] **Digital concept sketch by the artist** categories we've made to give us comfort about ourselves. *Machine Auguries: Toledo* offers us a technological simulation of nature, a recreation of a Toledo dawn chorus that can only ever be an imperfect copy of the fragile nature outside the Museum's doors.

JH While the dawn chorus pertains to the songs and communication of and between birds, what does the dawn chorus and its evolution signify more broadly in *Machine Auguries*?

ADG The generative adversarial network (GAN) developed to create the artificial birdsong for this piece uses a form of call and response that itself evokes the communication between birds. The GAN is a pair of neural networks that are effectively in conversation with each other. After being trained on thousands of clips of a particular bird species' song, one network creates a call. The other evaluates it. Does it sound like what it learned? The first network sings again and the second evaluates. If all goes well, over many cycles or "epochs" of learning, which take place over a number of days, the calls sound increasingly lifelike to our ears.

But we are not robins or cardinals. What sounds "real" to us—and to a machine based on what it has learned—may be unintelligible or worse, meaningful in the wrong way, to a bird. We will never know what it is to be a robin. The machine may simulate the communication between birds, or the learning that birds undergo as they converse and their songs become more complex, but devoid of context, the sounds it makes are not real. The real cannot be replicated. But the artificial can teach us to listen. In ancient Rome, augury was the practice of interpreting the future from the behaviors of birds. This augury is telling us to listen.

[FIG. 2] **Digital concept sketch by the artist**



JH The artificial intelligence technology Generative Adversarial Networks (GANs) utilized in *Machine Auguries* is typically used to generate AI imagery. Can you speak more about your thinking in using it for sound instead? What can sound communicate that a visual experience may not?

ADG GANs are also used to make images known as “deep fakes”, pictures that look so real to our eyes that it is only the uncanny errors that give them away. Our eyes and brains can spot a glitch in an image —a misplaced shadow, an oddly-arranged face, but as technology advances, these are increasingly rare. The text generator ChatGPT and image tools like DALL-E and Midjourney have launched generative AI into everyday conversation as homework and even jobs seem threatened. One of the many ethical and existential challenges these tools raise is that they have been trained on text or images without their creator’s consent, to be used to create new material. Without writers and artists making new images to feed these tools, where will innovation come from - will we be stuck in a feedback loop where we can only construct things from what already exists?

Using this technology to recreate animal sounds reveals new questions too. While it’s harder for us to discern what sounds “correct”, we also have to think about meaning in language, and about what new meanings we can construct when we cannot ever truly understand or evaluate them.

What is our role as modern humans? We are obsessed with being creators and exploiters, not caretakers and listeners. Machine Auguries: Toledo takes a perverse route through the most artificial of experiences to lead us back to the natural world.

JH Temporality is a critical component of this installation. What is the role of time, and the experience of it, in this work?

ADG The dawn chorus peaks over the half hour before and after the sunrise as different birds enter and exit, but some sing long before and many continue after. *Machine Auguries: Toledo* compresses this arc into a shorter composition, but the birds come and go according to the order of the natural chorus. The piece begins with a “real” bird singing and a very imperfect machine bird responding. As time passes, and the darkness lifts, these artificial birds become increasingly lifelike as the machine learns. What’s real and what’s artificial become harder to distinguish. There is intentional discomfort: something is clearly not right here. Glitching machine sounds disturb the birdsong, as the deep blue of the pre-dawn light shifts into the peaches and golds of the sunrise. But these electric lights are only a substitute for the sky. By the end, it’s less clear what is true. I hope this time for meditative reflection leaves visitors transformed: stepping back into the light of the museum in a state of mourning for what is not yet lost, tinged with a guilty realization that they haven’t been listening, but hopeful and enthused to get up for the dawn to experience—and protect—the real thing.

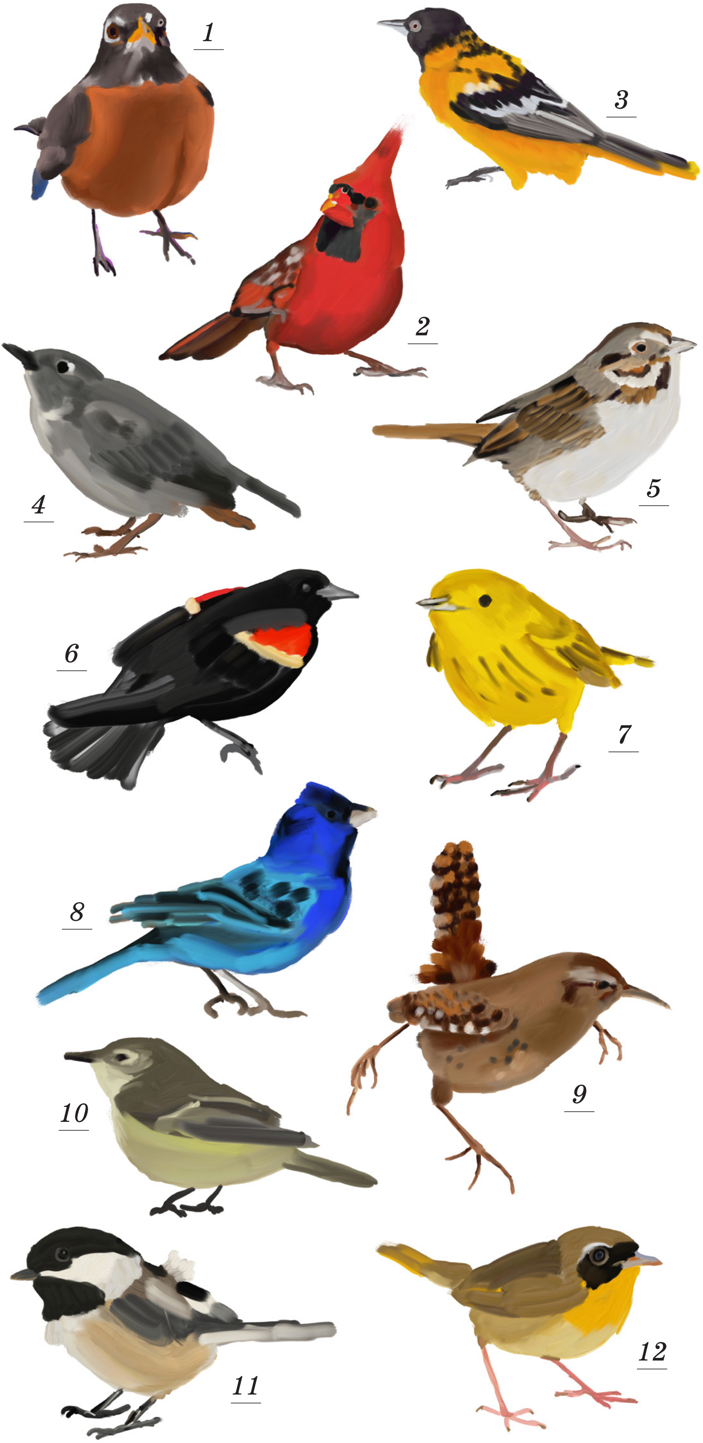
JH *Machine Auguries* not only reflects on the impact of humans on the environment, but also demonstrates that we and the natural world are intertwined, which is such a powerful notion. What are some of the other critical questions that you are hoping visitors will continue contemplating after their experience with *Machine Auguries*?

ADG Birdsong is being disturbed by human-induced habitat loss, as well as the more insidious effects of noise and light pollution. Low frequency, human-made noise such as traffic, and even the sound distortion caused by architecture, means that birds are having to sing higher to communicate, if they can. Each year, levels of outdoor artificial lighting are increasing, and the night is becoming around 10% lighter year on year. The idea that nature is never-ending and infinitely resilient is misleading. Nature itself is resilient, but the bits of it that we value are not necessarily so. The biodiversity that keeps the environment we value functioning is fragile, and technologies, however clever they are, won't solve the problems we have created. Humans, our societies and values, create change. We can use technologies as transformational tools, but we have to transform ourselves first. ▪

The artwork's title, *Machine Auguries*, is inspired by William Blake's "Auguries of Innocence" (written circa 1803; published 1863). Lines from the poem title each interview in this guide. Scan the QR code to read the full poem.

BIRD SPECIES

FEATURED IN MACHINE AUGURIES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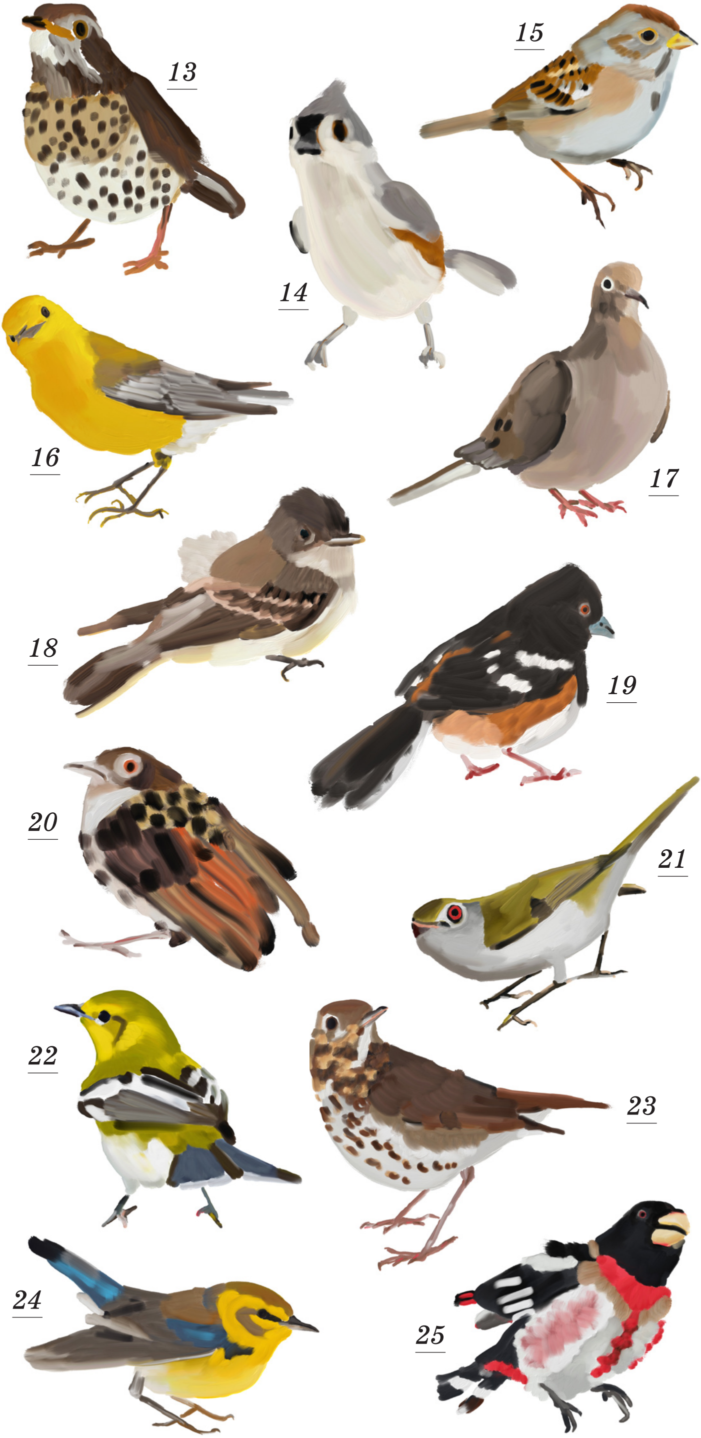
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1 **AMERICAN ROBIN** *Turdus migratorius*

While some flocks of robins remain in the Toledo area all winter, it's a sign of spring when individual robins appear in March in backyards and parks all over the region. Male American robins are usually among the first birds to begin singing in the morning, often before the first hint of daylight. Their rich caroling may continue for hours.

2 **NORTHERN CARDINAL** *Cardinalis cardinalis*

The official state bird of Ohio (and six other states), Northern cardinals are common in the Toledo region year-round, adding a touch of color to gardens, parks, and forest edges in winter. Males and females deliver the same clear, whistled songs. Male cardinals sing more than females, usually from higher perches, and are among the first birds to begin singing at dawn.

3 **BALTIMORE ORIOLE** *Icterus galbula*

With mellow, melodious whistles accompanying its rich orange-and-black colors, the male Baltimore oriole is a delight for the senses. Each male's song has its own particular pattern of notes. In the Toledo area, Baltimore orioles are most abundant in May, when many pause here during their migration north from the tropics. Summer resident orioles can still be seen in tall trees in forests, parks, and yards.

4 **GRAY CATBIRD** *Dumetella carolinensis*

From the beginning of May through the summer, thickets and woodland edges around Toledo come alive with the gray catbird's disjointed series of harsh and melodic notes, interrupted by the occasional catlike *meow*. They seem to make an infinite variety of sounds. Male catbirds may start to give a few disconnected songs before the first light of dawn, but sing more consistently close to sunrise and through the morning.

5 **SONG SPARROW** *Melospiza melodia*

In Ohio in the 1930s, detailed observations of song sparrows by Margaret Morse Nice helped set the stage for modern bird study. These tuneful sparrows can be found in thickets, woods, marshes, and gardens throughout the Toledo area. The varied, complex songs of the males may be heard at any season, but they sing most when trying to attract a mate in early spring, and during the first part of the nesting cycle.

6 RED-WINGED BLACKBIRD *Agelaius phoeniceus*

Red-winged blackbirds are commonly seen in spring and summer in marshy spots close to water in the Toledo area. They settle in the marshes very early in spring, and soon the males are belting out ringing, nasal tunes to announce territorial claims. Females also sing, but their notes are simpler. Males must vigorously defend their territories because they may have as many as five mates, and occasionally up to 15!

7 YELLOW WARBLER *Setophaga petechia*

The Lake Erie shore near Toledo is famous as "the warbler capital of the world," because so many species of these colorful little migrants pause there in spring. The yellow warbler stays here to nest in the summer and can be abundant in willows near ponds, rivers, and lakes. Males sing a series of thin, sweet notes, and often have two different song patterns: one sung mostly before sunrise, and another used mostly during the day.

8 INDIGO BUNTING *Passerina cyanea*

Arriving from the tropics, indigo buntings reach full numbers around Toledo in mid-May. They inhabit thickets, overgrown fields, and woodland edges throughout the summer. Males sing from a high perch on a branch or roadside wire, delivering a sprightly song of short, cheery notes, often in pairs. They sing before sunrise and continue off and on all day, even in summer when most other birds are quiet.

9 HOUSE WREN *Troglodytes aedon*

Bustling little fireballs of activity, house wrens seem to be in constant motion, and their explosive, bubbling songs carry the same energy. From wintering grounds in the southern states and Mexico, they reach Toledo in late April and May, spending the summer in woodlands, parks, and backyards all over the region. Males may sing almost constantly to attract a mate (averaging more than 10 times per minute).

10 **WARBLING VIREO** *Vireo gilvus*

In the Toledo area, warbling vireos arrive at the end of April from their wintering grounds in Mexico and Central America. Their pleasing, warbling songs may be heard from the treetops of wooded areas throughout the region. They may not begin vocalizing as early in the morning as some birds, but they are persistent singers, continuing to sing through the middle of the day.

11 **BLACK-CAPPED CHICKADEE** *Poecile atricapillus*

Active, acrobatic little birds of the treetops, black-capped chickadees are common all year in forests and parks of the Toledo region. In early spring pairs claim their territories with a whistled *see-bee-ee* song, given mostly by males. In addition to the song, they make at least 15 other kinds of vocalizations, including a fast, cheerful chatter that sounds like *chick-a-dee*.

12 **COMMON YELLOWTHROAT** *Geothlypis trichas*

The only member of the warbler family adapted to living in open marshes and wet meadows, common yellowthroats are indeed common in wetlands around the Toledo region in spring and summer. Most of the time they are out of sight, down in low, dense cover, but males perch atop bushes or tall cattail stalks to sing their rapid *wichity-wichity-wichity!*

13 **WOOD THRUSH** *Hylocichla mustelina*

The pensive, flutelike notes of wood thrushes have earned them a spot on the list of North America's finest singers. These shy birds of the forest interior are hard to see in summer, but their haunting melodies can be heard in wooded tracts near Lake Erie and in many local parks, especially in Oak Openings Preserve Metropark. Males do most of their morning singing from high in trees before sunrise, tapering off after daylight.

14 **TUFTED TITMOUSE** *Baeolophus bicolor*

Tufted titmice live year-round in forests and woodlots of the Toledo region. Beginning in early spring, males sing a melodious (if somewhat monotonous) whistled *peter-peter-peter* over and over from the treetops every morning. Females sing the same song, but more quietly. Both males and females also give a wide variety of other calls, some very similar to those of chickadees.

15 **FIELD SPARROW** *Spizella pusilla*

Brushy, overgrown fields are the preferred habitat for the sweet-voiced field sparrow. While a few remain in the Toledo area in winter, many more arrive in early April for the summer. Males usually perch atop the tallest bush in their territory to sing a series of plaintive whistles, gradually speeding up to a trill. Although they sing most often at dawn, they may sing at any time of day.

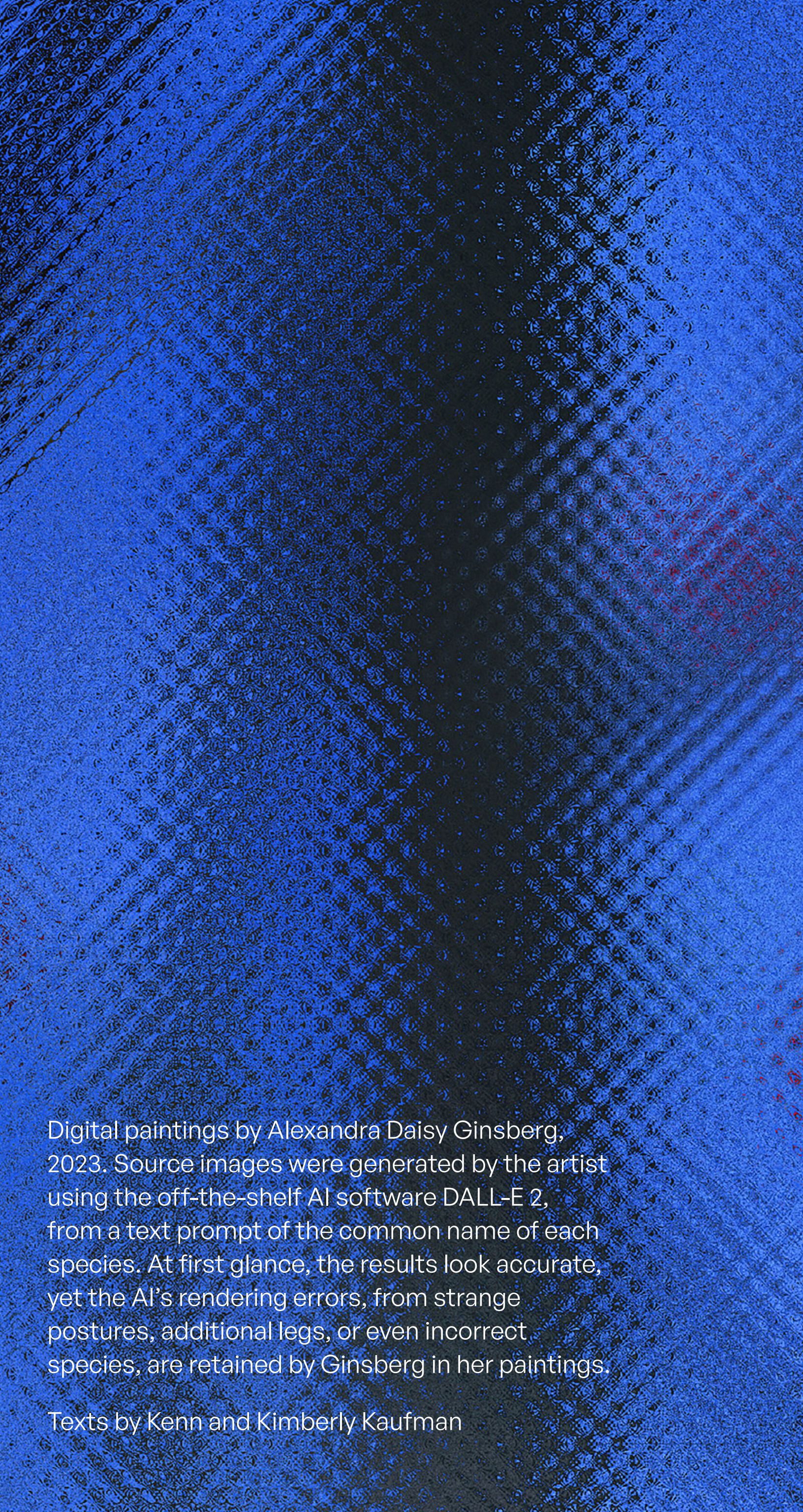
16 **PROTHONOTARY WARBLER** *Protonotaria citrea*

Brightly colored prothonotary warblers are mainly summer residents of swamps and flooded woods of the Deep South. In the Toledo area they are near their northern limits, but they regularly nest every summer in swampy woods near Lake Erie and sometimes along the Maumee River. Males usually perch high above the water to sing a loud, emphatic *weet weet weet weet*. They sing much more often while trying to attract a mate.

17 **MOURNING DOVE** *Zenaida macroura*

Named for the mournful tone of their cooing, mourning doves are numerous in towns, farmland, and forest edges throughout the Toledo area, especially in summer. From a high treetop or roadside wire, a male will give a five-note song—*coo-AAH coo, coo, cooo*—frequently until he attracts a mate. He uses an abbreviated, two-note version of this song during the time the pair is building their nest.

18	**EASTERN PHOEBE**	*Sayornis phoebe*
19	**EASTERN TOWHEE**	*Pipilo erythrophthalmus*
20	**OVENBIRD**	*Seiurus aurocapilla*
21	**RED-EYED VIREO**	*Vireo olivaceus*
22	**YELLOW-THROATED VIREO**	*Vireo flavifrons*
23	**SWAINSON'S THRUSH**	*Catharus ustulatus*
24	**BLUE-WINGED WARBLER**	*Vermivora cyanoptera*
25	**ROSE-BREASTED GROSBEAK**	*Pheucticus ludovicianus*



Digital paintings by Alexandra Daisy Ginsberg, 2023. Source images were generated by the artist using the off-the-shelf AI software DALL-E 2, from a text prompt of the common name of each species. At first glance, the results look accurate, yet the AI's rendering errors, from strange postures, additional legs, or even incorrect species, are retained by Ginsberg in her paintings.

Texts by Kenn and Kimberly Kaufman

TOOLS WERE MADE & BORN WERE HANDS

Interview *

ALEXANDRA DAISY GINSBERG
Artist

KAREN BAKKER
Researcher of digital innovation and environmental governance, University of British Columbia
karenbakker.org

ADG I've sent you a sound clip.

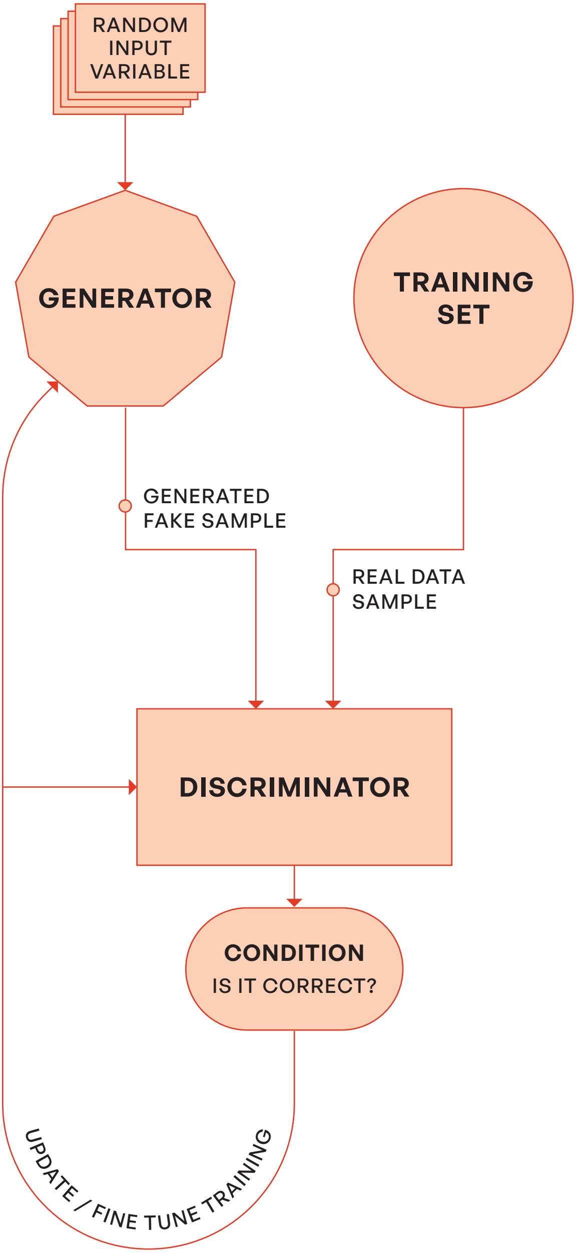
Karen Bakker I can hear it.

ADG That's a four-second clip of American robin as sung by a GAN [generative adversarial network], trained to sing like a bird. I've made this artwork once before, on a much smaller scale in 2019 for an exhibition here in London, using UK bird species. The technology has advanced so much in the last three and a half years that we can now generate four-second clips, up from one second. We're working with the [Cornell Lab of Ornithology's] Macaulay Library; they shared about 100,000 field recordings with us to build training datasets for 11 Toledo bird species.

The installation is a large gallery where the audience sits underneath a dawn simulation: a sky of strip lighting starts dark blue and transitions to the dawn. What's odd is we're getting people inside to listen to the fake dawn chorus so that they can think about the real dawn chorus.

My work is about the simulation of nature and using simulation to bring attention to the inaccuracy of the copy. We can't recreate the natural world; there's obviously so much context and nuance that

[FIG. 3] **Generative adversarial network (GAN) system model**



is lost. To us, this clip sounds like Robin. But to a robin, it might not be Robin. The thousands of recordings we've used to train the GAN are taken out of context.

In your book [*The Sounds of Life*], you explore new digital tech as a means of listening to the hidden sounds of nature, and you also draw on Indigenous knowledge and listening as a motif to highlight our lack of listening, and this difference from Indigenous practices. You quote [environmental biologist and member of the Citizen Potawatomi Nation] Robin Wall Kimmerer talking about scientific "discovery" as a very egocentric and Western way of looking at experimentation on the natural world. Really, we've just not been listening. I found this so powerful: encouraging us to take the time to listen to what nature is telling us. The scientific researchers you highlight are *listening*. But I'm involved in this weird other side of what AI can do: the construction of new things. I'm essentially looking at the ChatGPT of birdsong. I'm curious to explore what that means, or what it could be for, or is it just as egotistical as what's come before?

KB The scientific amnesia that is evident in the disciplines of bio- and ecoacoustics is not unique to those disciplines. Western science – when engaging with the study of life in all its forms and the study of our planet – has amnesia about Indigenous and traditional knowledge. Robin Wall Kimmerer has that very beautiful quote, "Listening in wild places we are audience to conversations in a language not our own." This is long-held knowledge and we're just rediscovering it. But the methods we use to rediscover it are perhaps not as fulsome, not as integrated, and perhaps more dangerous than traditional, deep listening methods.

As you mentioned, digital acoustics essentially creates simulacra. You've created a simulacrum. The generative AI began with sound clips, but even prior to that, even simply recording nature's sounds creates simulacra. We're not listening to the animals themselves in their environment. We're listening to a digital recording. It is a profound mistake to think that that is the same thing as being in nature and listening. Moreover, when these sounds are either above or below human hearing range or when we slow them down or speed them up to listen to them, they don't sound like what they would sound like to that animal or that insect. We'll never know what that song sounds like to a bat, because we have to listen to it at a much lower frequency. This gets back to this long-standing debate in philosophy: [Ludwig] Wittgenstein said that "If a lion could speak, we could not understand him," or [Thomas] Nagel's paper "What Is It Like to Be a Bat?" Nagel argues that we can never know what it's like to be a bat because we're not embodied, and that language is inseparable from our bodies and our environments; our umwelts are biophysical contexts.

If we take those arguments seriously, this means that the digital representations of nature are no more real than a painting. But because they are new to us, and they are multisensorial, it might be easier to mistake them for the real thing. I think therein lies the kind of enchantment and the enlivening aspect, but also the danger. How truly odd at the start of this century to think of people going into a room and listening to a fake recording of a dawn chorus when they could be going out and listening to the real thing. How truly odd our great-great-great-grandchildren will think we were.

ADG Yet this may be the archival record or the closest thing to it.

KB Right? And these fantastic examples can cultivate surprise and delight and maybe empathy. But humans and their domestic animals are 96% of mammalian biomass. Wild mammals are only 4%. We've truly colonized and appropriated the biosphere. In this context, this is voyeuristic, if not sadistic. It's like California having exterminated the grizzly bear and then putting the grizzly on its state flag. At the same time, these [representations] are very, very important in an era when very few people will get to experience nature in the wild, in real time. And there must be some way of cultivating a sense of connection and urgency about conservation in the context of a global population that is highly urbanized or highly distanced from nature. These are very ambivalent tools. They're powerful, but they're very ambivalent.

There's an aspect of science, particularly biology and ecology, that functions essentially like a killing jar, that we kill these things in order to study them. We collect specimens. But to inject a slightly hopeful or interesting note: whereas Victorian natural scientists like [Henry Wallace] Bates would go out and kill so many specimens, today we can take digital photos or do digital acoustic recordings *in situ* with much less invasive human presence, and those become our new collections. We can imagine maintaining or even increasing our knowledge of the natural world while not needing to kill or intervene in the ecosystem to study it. That is one of these ambivalences about the digital agenda because that's probably a positive thing from an animal's perspective: not to have the diver on the coral reef prying up the coral, but just leaving a digital recorder and going away.

ADG You raise the ethical issue of this kind of data being used for nefarious purposes. If we can start to understand what elephants are saying, then poachers can understand them too, or understand how shoals of fish are communicating, we have a way to exploit nature further. Where does listening step into eavesdropping? Should we be able to listen? I'm curious about how governance comes into this. It's fascinating, for example, how so much whale research came out of US military Cold War technologies.

KB Precision fishing for precision hunting, and indeed a digital arms race between poachers, gamekeepers, and wardens who are trying to protect species using these technologies, and the militarization of conservation that can occur around these technologies are all concerns about eavesdropping. Indeed, it is a form of eavesdropping. It may be in the future that our descendants will look back and say, "How could they have treated non-human persons this way? They simply eavesdropped. And they didn't ask for consent. They had no safeguards. They didn't do a very good job of protecting human digital data, but at least they knew they had to. But then they were completely derelict in their duty to protect nonhumans' data." And that has to do with a very anthropocentric view of viewing these creatures in any way as having rights or personhood.

To return to the Indigenous perspective, another gap here is Indigenous data sovereignty. Much global biodiversity is on traditional territories of Indigenous peoples that have higher rates of biodiversity than elsewhere. There are some jurisdictions, like New Zealand or Canada, where an actual legal framework exists for Indigenous data, meaning that Indigenous communities should control the data emerging from these territories. We shouldn't simply be harvesting it. It's not free. It has to have owners or guardians.

ADG That's so interesting. I'm aware of the Nagoya protocol covering bioprospecting, but not the acoustic data aspect.

KB This is a form of acoustic bioprospecting.

ADG Another work I've made in the last few years is *Pollinator Pathmaker*. I created an algorithm that designs gardens from the perspective of pollinators to think about this problem of encoding altruism into an algorithm. Can we create technology that's not for our benefit, but for the benefit of other species? The algorithm creates garden designs that maximize pollinator diversity rather than prioritize human aesthetics. We have a database of plants, and we know which pollinators visit each plant. The algorithm optimizes the solution each time to arrange plants, so that we've got blooming across the year, and support moths, wasps, bees, beetles, and so on. How can these technologies benefit other species, as well as empower people to have agency and to connect to other species? It foregrounds the pollinators and the plants and their interactions as the artwork, rather than a representation of them.

It comes back to this question of the constructed versus the listening version of these technologies. With the birdsong, we're making gobbledygook. There's an ethical question of what it would mean to play the artificial robin to a real robin. Are we just creating more noise pollution?

KB Or trolling them. Playback experiments are quite distinct from generative AI where you don't know if there's any informational content. ChatGPT is such a good pastiche machine, there might be some information, but what's an avian version of misinformation? Or toxic hate speech?

ADG These questions show how our Western value system is focused on innovation, rather than preservation. Since we *can* construct a new dawn chorus, I'm going to create one, when people instead could go outside and listen to the real dawn chorus. But maybe that is what it takes to get us outside, to listen again.

For this dawn chorus, we're recruiting the bird species that are both local and migratory that create Toledo's unique soundscape. We could do it for other cities or locations and create other synthetic choruses. I was curious about—and maybe it's a matter of ethics as well—the idea of a unique acoustic soundscape, how that sits in a wider conservation strategy. Is that something that should be preserved, and is it a good measure of health?

KB The spectrogram is a snapshot in time. If you take a spectrogram of a soundscape—the collection of sounds in a landscape—you can interpret that spectrogram as it evolves over time to track certain ecological measures. For example, we have ecoacoustic indices. There's a huge debate about how effective these indices are, what they measure, and how they should be aggregated. Bioacoustics listens to individual organisms, while ecoacoustics listens to entire soundscapes. You can use ecoacoustic techniques to monitor the health of ecosystems over time; you can also use them for bioacoustic purposes.

Scientists discovered an entirely new species of pygmy blue whale in the Indian Ocean recently. They're hiding deep beneath the waves, and we can't see them. They're really far from centers of human population, and yet, because their songs travel hundreds of miles underwater, they were able to pick them up. We can track species going extinct, we can find new species, and we can look at the overall health of the ecosystem; they're very powerful tools.

ADG How can we situate acoustics in a place? We're so used to seeing the world with our eyes, but this aural soundscape is unique and something to protect. For the audience, what they're hearing in Toledo *is* Toledo. It doesn't exist anywhere else. Once lost, it's lost. It can't be reconstructed.

KB Each soundscape will have a unique acoustic signature. You could argue that what you're doing is recording acoustic fossils before they disappear, especially with endangered species. Each locale has a unique soundscape that's composed of the biophony and the anthrophony—the sounds people make, and the geophony—the sounds made by abiotic parts of our environment. You could probably train an AI and could record the soundscape of different places, and the AI could tell you, "Oh, that's Toledo. Oh, that's Los Angeles."

ADG That's a really interesting prospect. We could also use generative AI to fill in the gaps. We know that this bird is on this part of the phylogenetic tree, and sings like this, and another bird sings like that. Can we create a generative sound to fill in the gap as a predictive tool?

KB Yes. There is some speculation about the acoustic niche hypothesis: just like every station on the radio dial is going to be filled by something, one would expect to see acoustic niches filled. That gives you some predictive power. Sound even helps us to reclassify species. For some amphibian examples, where maybe there's some debate in the community about whether that's the same species or two different ones, if they have sufficiently different vocalizations, they decide "Okay, they're two different species." This is one of the markers they now use in addition to physical distinctions.

I hope we get to talk again about the many other levels at which sound operates. It's physiological, it's emotional, it's spiritual, as well as scientific. And so it resonates, pun intended, at many different levels with people. ▪

WHEN WE SEE NOT THRO THE EYE

Interview

ALEXANDRA DAISY GINSBERG
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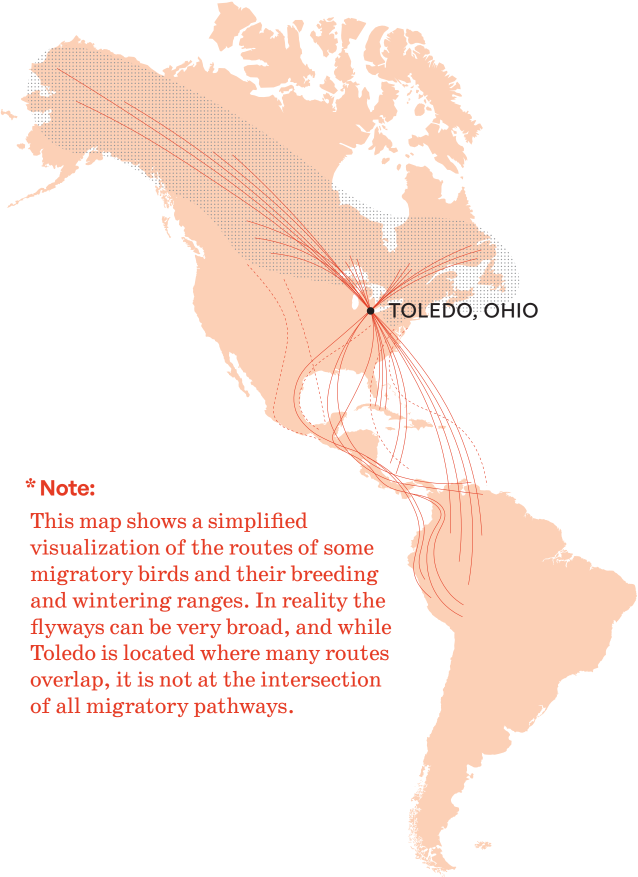
ADG Can you explain what the dawn chorus is and why it’s important?

Kaufmans We might just think of bird songs as beautiful bits of music—and they are!—but for the birds, these sounds have practical value. The singing is done mostly by males, and mostly in the breeding season, for two important functions: to defend the territory around the nest, and to attract or keep a mate.

Although some birds may sing at any time of day, there is a crescendo of song right around sunrise during spring and summer. At dawn it may be too dark for them to hunt for food, but it’s a good time for males to announce “I’m still here” to their mates or to rival males. Also, many songbirds migrate at night, so at dawn new arrivals might be showing up. By singing, the local birds can assert their claims to their nesting territory.

The dawn chorus may begin at the first hint of light in the east, with just a few individuals singing. As the light increases, more species join in. By the time the sun comes up, many birds are singing everywhere, with each species adding its own unique tune to the joyous, jumbled choir. The level of song will gradually diminish during the first couple of hours after sunrise, as birds get busy with foraging for food or other activities. Some will continue singing even in the heat of the day, and there may be a resurgence of song at dusk, but nothing to rival the magic of the dawn chorus.

[FIG. 4] **Central, Mississippi & Atlantic Flyways***



*** Note:**

This map shows a simplified visualization of the routes of some migratory birds and their breeding and wintering ranges. In reality the flyways can be very broad, and while Toledo is located where many routes overlap, it is not at the intersection of all migratory pathways.

ADG What is it about the Toledo dawn chorus that makes it special?

Kaufmans With its location at the southwestern corner of Lake Erie, the Toledo area is perfectly situated for enjoying a diverse range of bird songs. Varied local habitats include forest, prairie, farmland, the unique Oak Openings region, and the extensive western Lake Erie marshes, each with its own distinct suite of songbird species.

Some local birds are present year-round, but a greater number are migratory. A few of the winter resident species start singing in very early spring, before they leave for the north. Our summer residents, the birds that will stay here to nest and raise their young, burst into full song as soon as they arrive from the southern states or the tropics in spring.

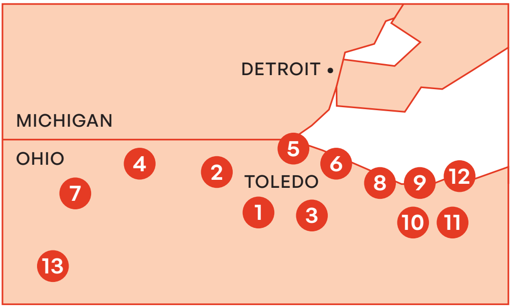
In addition, we hear many songs from birds that are just passing through. This region is famous as a stopover habitat for northbound migrants, with immense numbers pausing at the southern edge of Lake Erie to rest and feed before they continue their journeys. By the time they reach the latitude of Toledo, getting closer to their nesting grounds, many are in full song, as if practicing for the brief breeding season.

ADG What challenges of contemporary society are there and how is this impacting the dawn chorus and conservation on a wider scale?

Kaufmans Like so many other things in nature, the dawn chorus is affected by human activities. Several studies have shown that birds living in noisy urban surroundings tend to start singing earlier in the morning than those in natural habitats. Some also begin singing more high-pitched notes, and they may stop singing altogether during times of peak noise close to busy roadways or airports. All these shifts occur because the songs are useless if other birds can't hear them.

Sadly, the total amount of song has diminished in many areas, as bird populations have decreased due to a loss of habitat. Humans may unintentionally shut out the music of the birds, even when we're outdoors, by listening through earbuds or focusing on our phones. It's worth the effort to go out at sunrise in spring or summer, to go to a park or forest or meadow, and simply listen, to experience the beauty of the dawn chorus. ■

[FIG. 5] **Select Toledo area birding locations**



#	**BIRDING LOCATIONS**	Distance from TMA
1	MIDDLEGROUNDS METROPARK	1.9 mi
2	HISTORIC WOODLAWN CEMETERY	1.9 mi
3	PEARSON METROPARK	6.8 mi
4	WILDWOOD PRESERVE METROPARK	8.4 mi
5	CULLEN PARK	9 mi
6	MAUMEE BAY STATE PARK	12 mi
7	SECOR METROPARK	14.1 mi
8	HOWARD MARSH METROPARK	16 mi
9	METZGER MARSH WILDLIFE AREA	20.8 mi
10	OTTAWA NATIONAL WILDLIFE REFUGE	23 mi
11	BLACK SWAMP BIRD OBSERVATORY	23 mi
12	MAGEE MARSH WILDLIFE AREA	25.4 mi
13	OAK OPENINGS PRESERVE METROPARK	26.3 mi

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